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JAN 82 M R STONEBRAKER, E WONG DAAG29-79-C-0182
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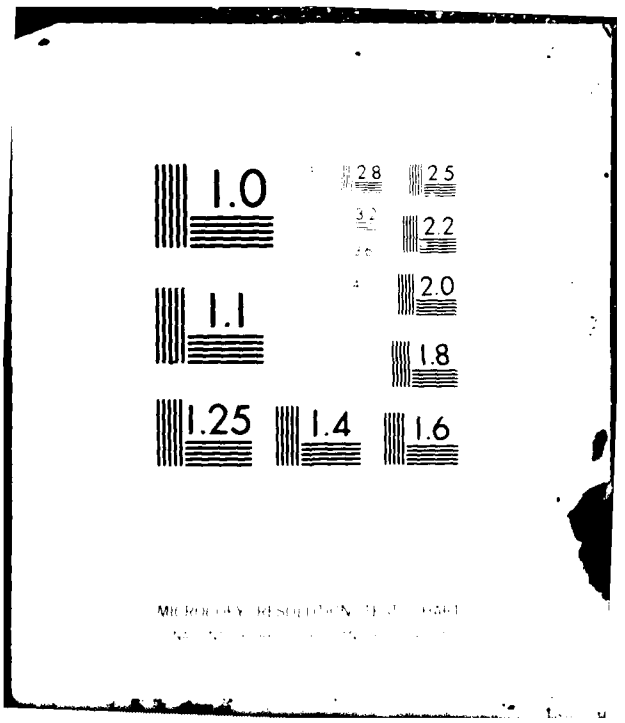
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EQUIPMENT FOR RESEARCH IN DATABASE MANAGEMENT

AND

RESEARCH IN DATABASE MANAGEMENT

FINAL REPORT

M. R. Stonebraker and E. Wong

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COLLEGE OF ENGINEERING
UNIVERSITY OF CALIFORNIA, BERKELEY
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

distributed database, INGRES, crash recovery, query processing

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Research in three areas of distributed database systems is reported. These are: implementation of distributed INGRES, distributed query processing, distributed crash recovery.

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1. Major Problems Studied

The problems studied under this grant were mainly those related to distributed databases. Specifically, the following topics were investigated:

1.1. Implementation of Distributed INGRES

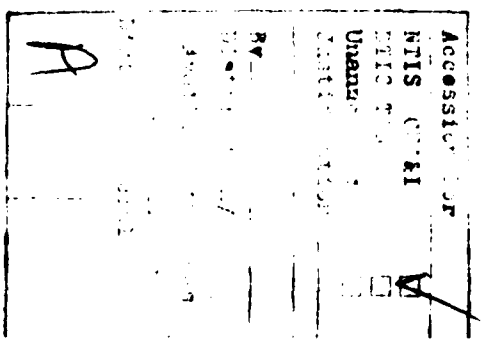
A major task undertaken was the implementation of a distributed version of the INGRES database management system. While many distributed database management systems have been proposed, very few have been implemented. Some important issues in distributed database management, especially those pertaining to performance, are unresolvable without an implementation effort.

1.2. Distributed Query Processing

Beginning with [WONG 77], distributed query processing has received a great deal of theoretical attention. However, most proposed approaches have been based on the original model which assumed that no redundant copies were used even if available. As a result, potential efficiencies due to multiple copies have not been realized. A major goal in our program was to remedy this deficiency.

1.3. Distributed Crash Recovery

Crash recovery in a distributed database system has been studied extensively, but the proposed protocols are often ad hoc in that the class of failures for which survival is ensured is rarely delineated. A formal model that would allow any proposed protocol to be evaluated with precision is very much needed.



2. Principal Results and Achievements

2.1. Implementation

A 2-machine prototype of distributed INGRES was completed in March, 1981 and publicly demonstrated. With few exceptions, all QUEL commands ran successfully on a database fragmented across two sites with the fragmentation transparent to the users. While the prototype implementation was successful, the communication link that was available was too slow for any performance information to be obtained.

2.2. Distributed Query Processing

A radically new approach to distributed query processing was developed. Known as "dynamical rematerialization," this approach views distributed query processing as a process of changing the available data at the different processing sites. Viewed in this light, existing algorithms are better understood and a number of new algorithms suggest themselves. The results are reported in [WONG 81].

2.3. Distributed Crash Recovery

A formal model for transaction processing in a distributed database system was developed by Dale Skeen and M. R. Stonebraker [SKEE 81]. This model was used to study both site failures and network partitioning. The class of site failures from which independent recovery is possible has been precisely identified. Results on recoveries from network partitions have also been obtained.

3. Personnel

R. Katz, Ph.D., June 1980

Dale Skeen, Ph.D., Dec. 1981

J. K. Ranstrom, (EA-1) Engineering Aide

Eric Allman, Senior Programmer

Robert Kridle, Development Engineer

4. References

[WONG 77] E. Wong, "Retrieving Dispersed Data from SDD-1: A System for Distributed Databases," Proc. 2nd Berkeley Workshop on Distributed Data Management and Computer Networks, 1977, 217-235.

[WONG 81] E. Wong, "Dynamic Re-Materialization: Processing Distributed Queries Using Redundant Data," Proc. 5th Berkeley Workshop, February 1981, 3-13.

[SKEE 81] D. Skeen and M. Stonebraker, "A Formal Model of Crash Recovery in a Distributed System," Proc. 5th Berkeley Workshop, February 1981, 129-142.

5. Publications

1. K. A. Youssefi and E. Wong, "Query Processing in a Relational Database Management System," Proceedings of the 5th International Conference on Very Large Data Bases, Rio de Janeiro, October 1979.

2. E. Wong and R. H. Katz, "Logical Design and Scheme Conversion for Relational and DBTG Databases," Proceedings of International Conference on the Entity Relationship Approach to System Analysis and Design, Los Angeles, CA, December 1979.

3. M. Stonebraker, "Retrospection on a Data Base System," ACM TODS, May 1980.

4. R. Katz and E. Wong, "Use of Semantic Data Model for Physical Data Base Design," Proceedings 1980 ACM-SIGMOD Conference, Santa Monica, CA, May 1980.

5. E. Wong, "Dynamic Re-Materialization: Processing Distributed Queries Using Redundant Data," Proc. 5th Berkeley Workshop, February 1981, 3-13.

6. D. Skeen and M. Stonebraker, "A Formal Model of Crash Recovery in a Distributed System," Proc. 5th Berkeley Workshop, February 1981, 129-142.

Through error on our part, the above six publications show Contract DAAG29-76-G-0245 and should have had joint acknowledgement with this contract.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